PLASTICATING SCREW FOR EFFICIENT MELTING AND MIXING OF POLYMERIC MATERIAL

ABSTRACT: A plasticating apparatus including a rotating and reciprocating screw having a helical flight disposed within and cooperating with the inner wall of a heated barrel. Solid resinous material is introduced to a helical valley extending between said flight to be heated and plasticized by said apparatus while being advanced towards an outlet opening by the rotation of said screw. The channel consisting of a leading flight a trailing flight and root section. The screw having a feeding section for conveying, a transition section preferably having an involute taper changing from a deep flight depth to a substantially shallower flight depth for melting, and a metering section for additional melting, mixing and pumping of said resinous material at high temperatures. The start of said metering section having a tangent point with said transition section where an increased change of helical flight pitch takes place whose purpose is to obtain a shallower metering depth with no decrease in channel volume. Said increase in helical flight pitch occurring at an incongruent motion with the involute taper of the root and when conditions are favorable, a second increase in the flight pitch and root takes place to obtain yet another decrease in the flight depth with a incongruent root to flight transition. An option when conditions warrant that after the first change has taken place as described above, a second increase in the helical flight pitch takes place whose purpose is to make room for helical mixing elements or intra-flights extending from said helical valley to induce a continuous separation and disruption of the molten resin in the metering section. Said metering section also having from time to time a cross channel barrier flight extending from helical valley and originating from the leading edge of the flight while crossing said channel to join with said trailing edge of flight, said barrier flight forming between a 15 to 30 degree acute angle when measured along the screw axis from feed end to metering end. Said intra-flights and cross channel barrier flights all occurring within the continuous primary flight channel of said metering section that functions to wipe the barrel wall each rotation, add additional melting capability, mixing capability and pumping.